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New species of the genus *Hepialiscus* HAMPSON (Lepidoptera, Hepialidae) from Taiwan

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Abstract Three new species of *Hepialiscus* HAMPSON are named and described; *Hepialiscus robinsoni*, *H. taiwanus*, and *H. monticola*. Their morphology is described and figured, and compared with *H. nepalensis* (WALKER) and *Oxycanus goldfinchi* TINDALE. The geographical distribution of the known oriental species of *Hepialiscus* and of its allied genera is shown.

Introduction

The genus *Hepialiscus* was erected by HAMPSON (1892) for a single species *Hepialus nepalensis* WALKER, 1856, and defined by the stalking in both wings of veins 8(R4), 9(R3), and 10(R2). TINDALE (1942) revised this genus in detail and stated "this genus is somewhat similar in its wing venation to *Oxycanus* but differs in the reduction of palpi" (p. 165). NIELSEN and ROBINSON (1983), however, stated that a grouping of taxa with oxycanine venation (sensu DUMBLETON (1966)) would probably be a paraphyletic entity. TINDALE (l.c.) also figured labial and maxillary palpi, antenna, fore leg, wing venation and male genitalia. TINDALE (l.c.: 166) figured the subanal sclerite (see below) vaguely in his figure 30, but he did not refer to this structure in the text. PFITZNER (1933) described *Hepialiscus borneensis* from Mt. Kinabalu, North Borneo. VIETTE (1950, 1953) described *Parahepialiscus baluensis* from North Borneo and *Xhoaphryx lemeei* from North Vietnam. Judging from VIETTE's description (1950) of R2-R4 as stalked and of the male genitalia having a subanal sclerite (his "garniture latérale, sclérifieé en forme d'Y, au pénis"), *Parahepialiscus baluensis* is closely related species to *Hepialiscus*, even though, unlike *Hepialiscus*, an epiphysis is present on the fore tibia. *Xhoaphryx lemeei* is also inferred to be closely related to *Hepialiscus*, because it has the following characters: 1) R2-R4 stalked, 2) fore tibia without epiphysis and 3) male genitalia with a subanal sclerite (he vaguely figured it in his fig 1.). VIETTE (1953) emphasized the difference of male genitalia, especially the shape of tegumen, between *Hepialiscus* and *Xhoaphryx*; the latter has an oval tegumen. A specimen of an unnamed species of Hepialidae, described by BRYK (1949), was assumed by PACLT (1953) to be closely related to *Hepialiscus kulingi* (DANIEL). The latter species was described in *Phassus* (DANIEL, 1940) but later transferred to *Hepialiscus* (DANIEL, 1949). Recently CHU and WANG

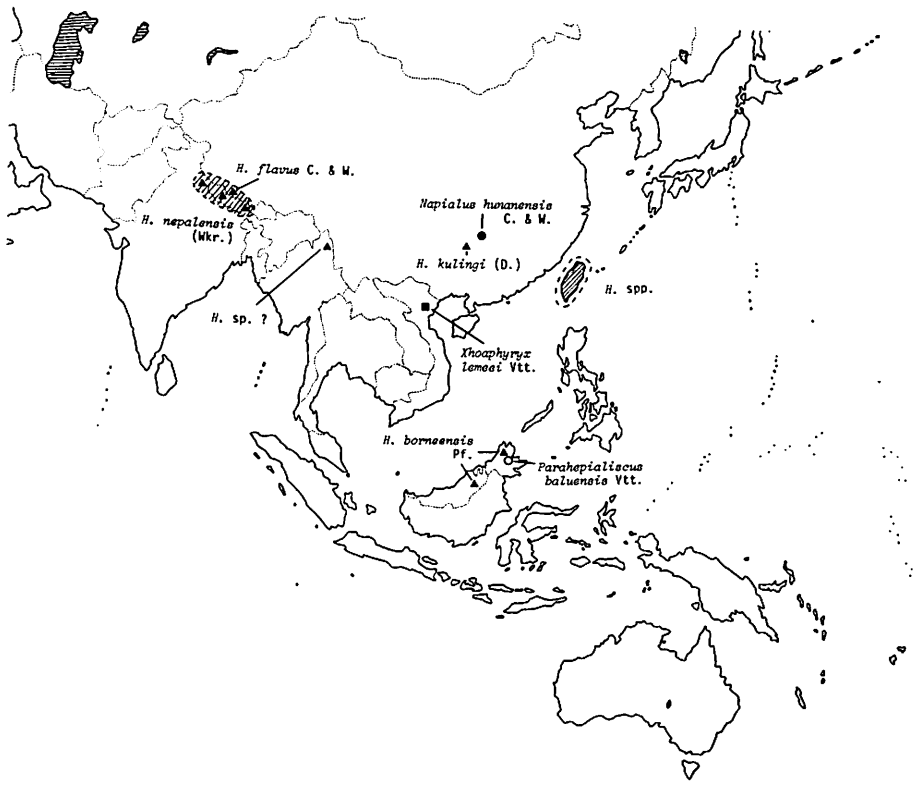

Fig. 1 Distribution of species of *Hepialiscus* and of its allied genera.

(1985) described *Hepialiscus flavus* from Xizang and also erected the new monobasic genus *Napialus* for *hunanensis*. *Napialus* was defined by the following characters; 1) R2 and R3 deeply forked, 2) CuP of hind wing not reached to termen, 3) the position of valva high in the male genitalia, 4) tegumen bearing serrations on the outer margin and with a long sclerite (subanal sclerite) ventrally , and 5) saccus narrow and long. These characters correspond to *Hepialiscus* except for 3), and *Napialus* is also inferred to be a genus related to *Hepialiscus*. This species group accordingly contains seven species (Fig. 1), but it needs more detailed examination in future.

In this paper I add three new species to the genus, the first record of *Hepialiscus* from Taiwan. The terminology used in descriptions of male and female genitalia follows mainly UEDA (1978, 1980) except for the subanal sclerites (DUMBLETON, 1966) (paramedial sclerites, NIELSEN and KRISTENSEN, pers. comm.) in the male genitalia. This structure was also observed in the male genitalia of *Oxycanus goldfinchi* TINDALE (fig. 7). Further study of this sclerite is needed to see if it provides evidence of any phylogenetic relationship between *Hepialiscus* and *Oxycanus*. Chlorazol Black E or MEYER's Haematoxylin were used for staining preparations. All scales on the figures represent 1 mm.

Acknowledgments

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Hepialiscus HAMPSON, 1892

Hepialiscus HAMPSON, [1893] 1892, Fauna Br. India (Moths) **1**: 317. Type-species: *Hepialus nepalensis* WALKER, 1856, List Specimens lepid. Insects Colln Br. Mus., **7**: 1557, by original designation.

Antenna filiform with 12–17 flagellar segments; apical segments almost black, remainder paler at each apex, giving a banded appearance to antenna. Female head smaller than male (Fig. 2). Vertex without thorn-like processes. Tentorial pits at 2/3 of lateral margin of frontoclypeus; labrum lightly sclerotized, with two pairs of dorsolateral sensory pits. Epipharynx not defined, mandible indistinct. Maxillary palpus with single short segment, lightly sclerotized. Labium almost oval and labial palpus one-segmented (Fig. 2–C). All legs without spurs (Fig. 3); arolium well-developed; fore leg without an epiphysis on the tibia; male hind leg not reduced and without scent-brushes. Fore wing 14-19 mm long, brownish or yellowish with bold, paler markings forming indistinct patterns. Costa straight; termen and posterior margin evenly curved; Sc unbranched, R1 weak, R3, R4 and R5 from R2; M complete, forked, arising from CuA; basal half of CuP present in fore wing. Hind wing fuscous to greyish brown, slightly tinged with ochreous on apical area of costa and cilia; R1 very weak (Fig. 4). Tuberculate plate present on 2nd to 6th abdominal segments (Fig. 5).

♂ genitalia. Eighth abdominal sternite present, heavily sclerotized and dilated posteriorly. Tegumen with a pair of dorsal projections (twin process of BIRKET-SMITH, 1974) well-developed on antero-dorsal region; subanal sclerite heavily sclerotized; processus momenti separated from tegumen by membrane or fused with

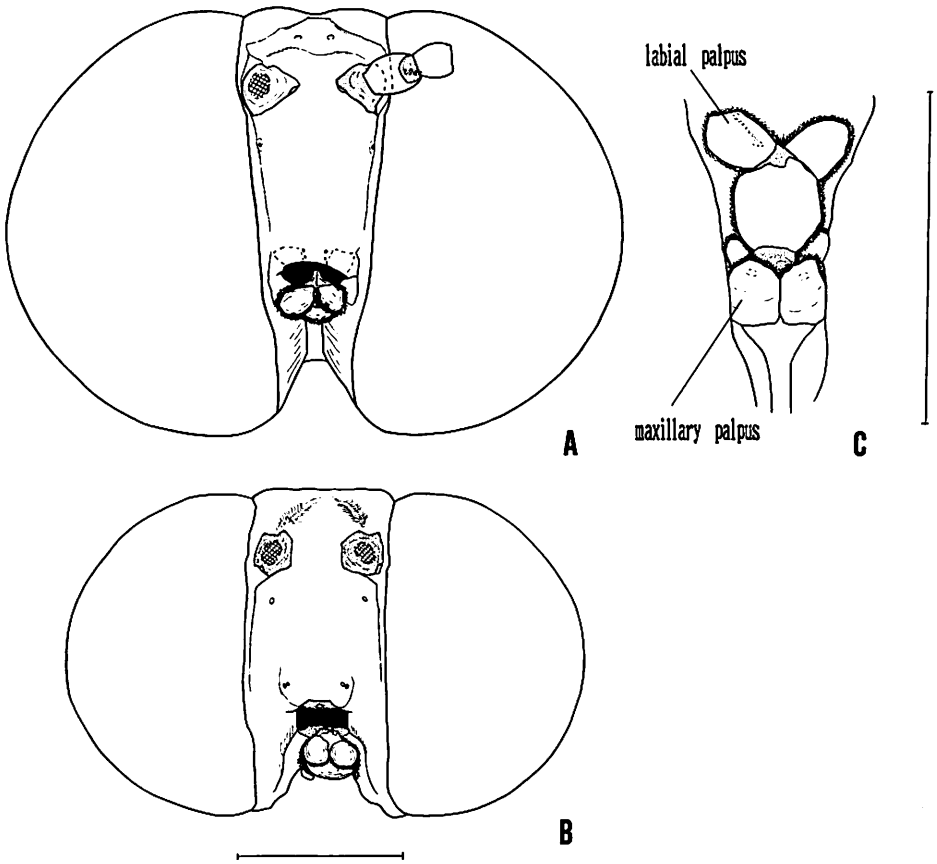


Fig. 2 Head of *Hepialiscus nepalensis* (WALKER). A: ♂, frontal view. B: ♀, frontal view. C: ♂, detail of labial palpus and maxillary palpus; ventral view.

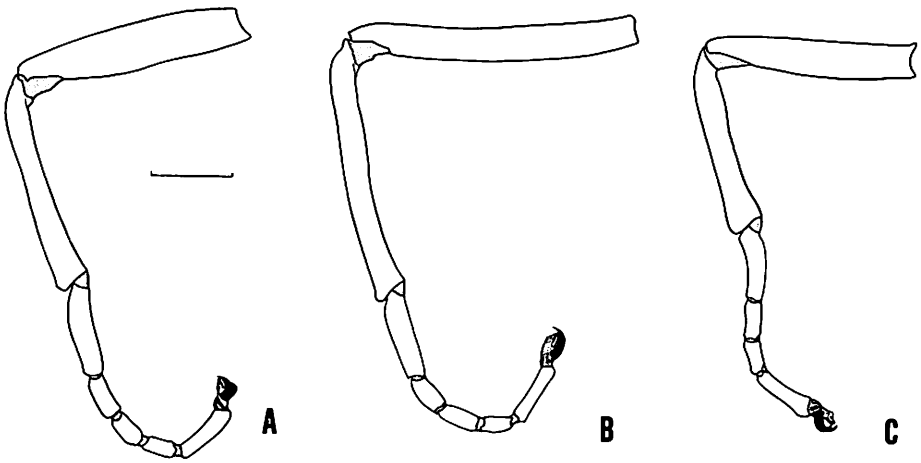


Fig. 3 Legs of male *Hepialiscus nepalensis* (WALKER). A: fore leg. B: mid leg. C: hind leg.

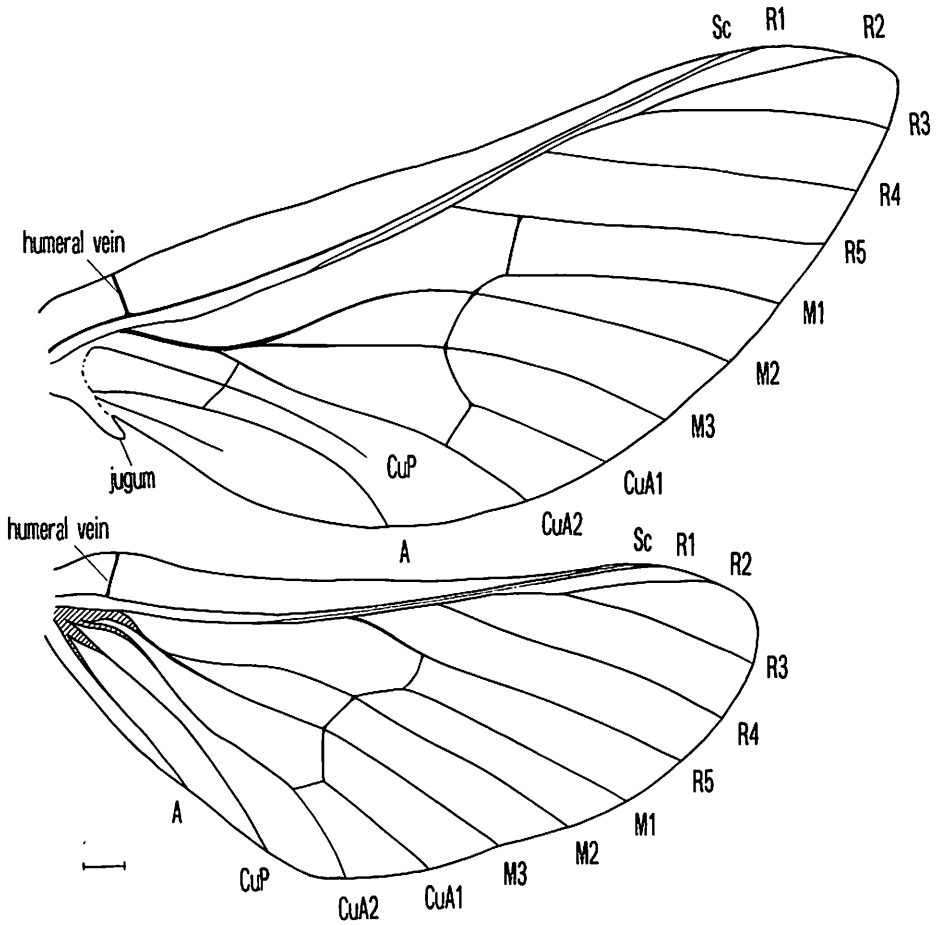


Fig. 4 Venation of *Hepialiscus robinsoni* sp. nov., holotype ♂.

it; valvella with heavily sclerotized ventral or posterior arms. Vinculum as deep as tegumen, without processes, stout and U-shaped; saccus semicircular. Valva simple, digitiform, without processes, and densely setose. Mesosome with arms not fused ventromedially. Tabulatum with a pair of lateral arms on the posterior margin, and with a keel-like structure on ventromedial area. Aedeagus not sclerotized (Figs. 6–7).

♀ genitalia. Ninth abdominal tergum roof-like, with lateroposterior margin produced posteriorly and densely setose. Subanal plates present on the diaphragma laterally, meeting each other medially and covering the seminal gutter. Ninth

1) The ninth abdominal sternum of *Hepialicus nepalensis* is much reduced (Fig. 8) and as such differs from other species of this genus.

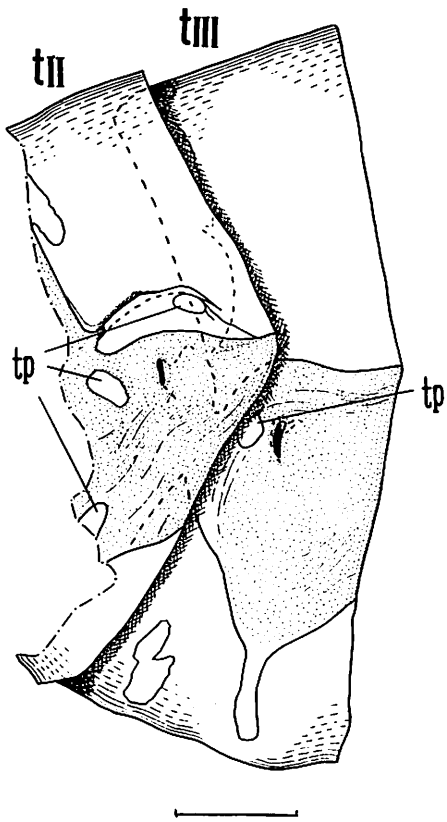


Fig. 5 Second and third abdominal segments of *Hepialiscus taiwanus* sp. nov., holotype ♂; tp, tuberculate plate.

abdominal sternum with a pair of lateral processes[1)], and a medial process. Apophyses absent. Bursa copulatrix with signum. Spermatheca well-developed (Fig. 8).

Description of species

Hepialiscus robinsoni sp. n.

♂. 19 mm. Head: vertex and frons ochreous, scales of vertex buff-brown apically. Antenna with 16 flagellar segments. Thorax and tegula buff-brown with ochreous. Fore wing dark brown and ochreous patterned with small white spots, each edged with dark brown; broken white postmedial line, and the posterior one forming a large white mark at the posterior margin; subterminal line of triangular white spots; a conspicuous white angular mark in middle of posterior margin. Hind wing greyish brown; apical region of costa and cilia slightly tinged with ochreous. Legs buff-brown. Abdomen brown and golden brown, bearing long greyish brown hairs dorsally on anterior half.

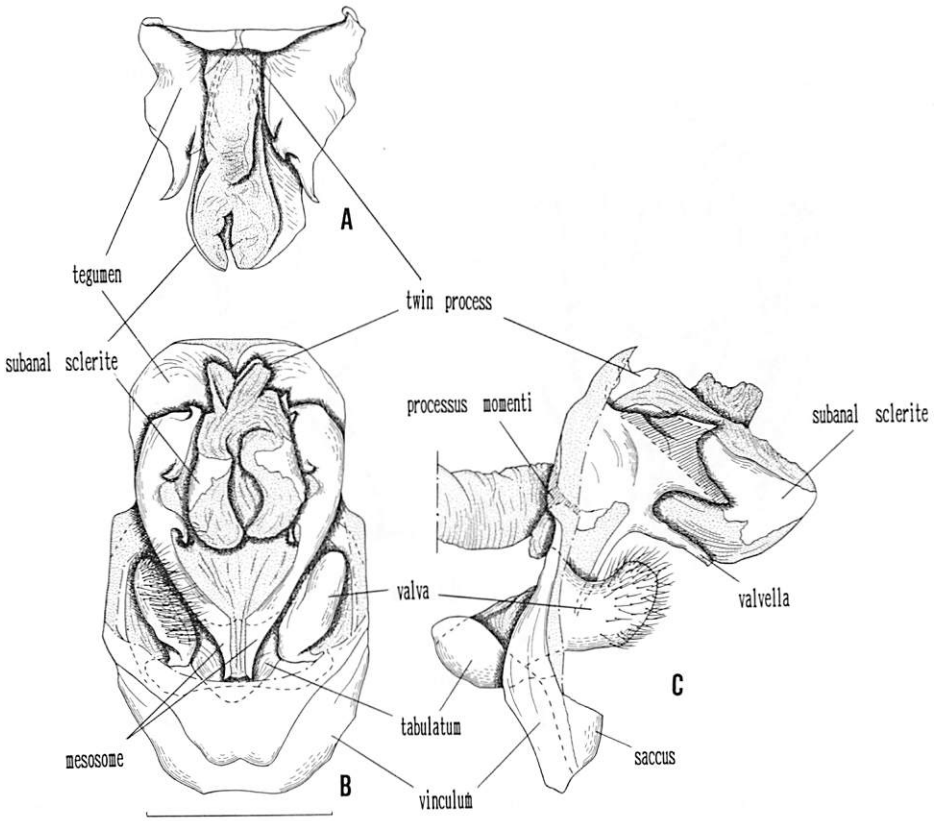


Fig. 6 Male genitalia of *Hepialiscus nepalensis* (WALKER). A: dorsum, dorsal view. B: whole genitalia, caudal view. C: ditto, lateral view.

♀. Unknown.

♂ genitalia. Tegumen broad about 1.4 times as wide as long; subanal sclerite abruptly projecting dorsally at the distal end, and ending in a blunt tip; posterior margin of tegumen with irregular dentations and acute processes; processus momenti definitely separated from tegumen, rounded. Valvella sharply pointed ventrally. Valva almost as long as wide, narrow. Mesosome terminating in a blunt tip.

Distribution. Taiwan.

Material examined.

Holotype ♂, Taiwan: Taiheizan (Taihoku-shû), 23. x. 1932. (Keishô SATÔ leg.) (in the collection of Entomological Laboratory, Kyushu University, Type No. 2705, Kyushu Univ.).

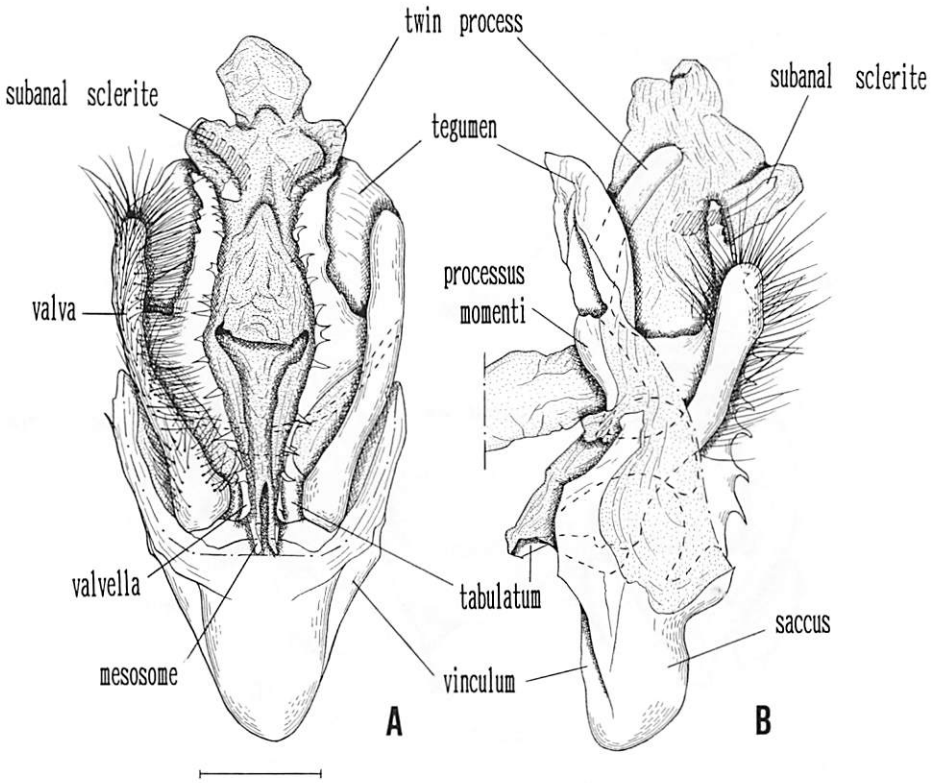


Fig. 7 Male genitalia of *Oxycanus goldfinchi* TINDALE. A: whole genitalia, caudal view. B: ditto, lateral view.

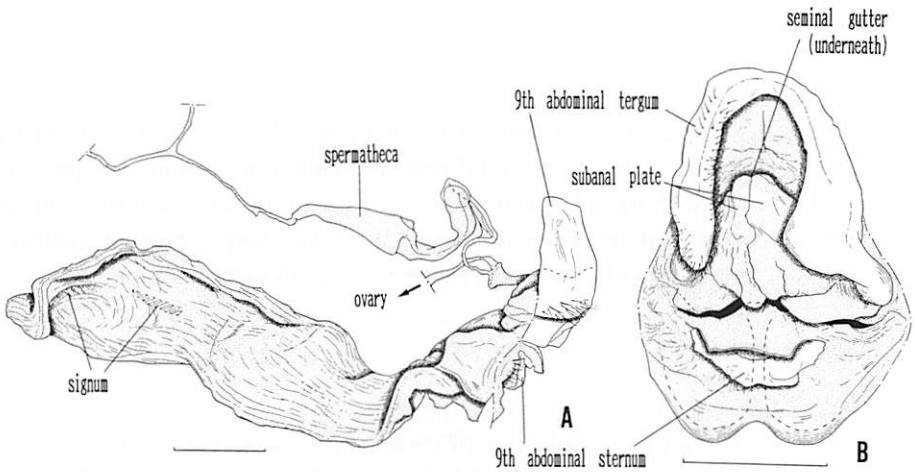


Fig. 8 Female genitalia of *Hepialiscus nepalensis* (WALKER). A: whole genitalia, lateral view (left). B: ninth abdominal segment, caudal view.

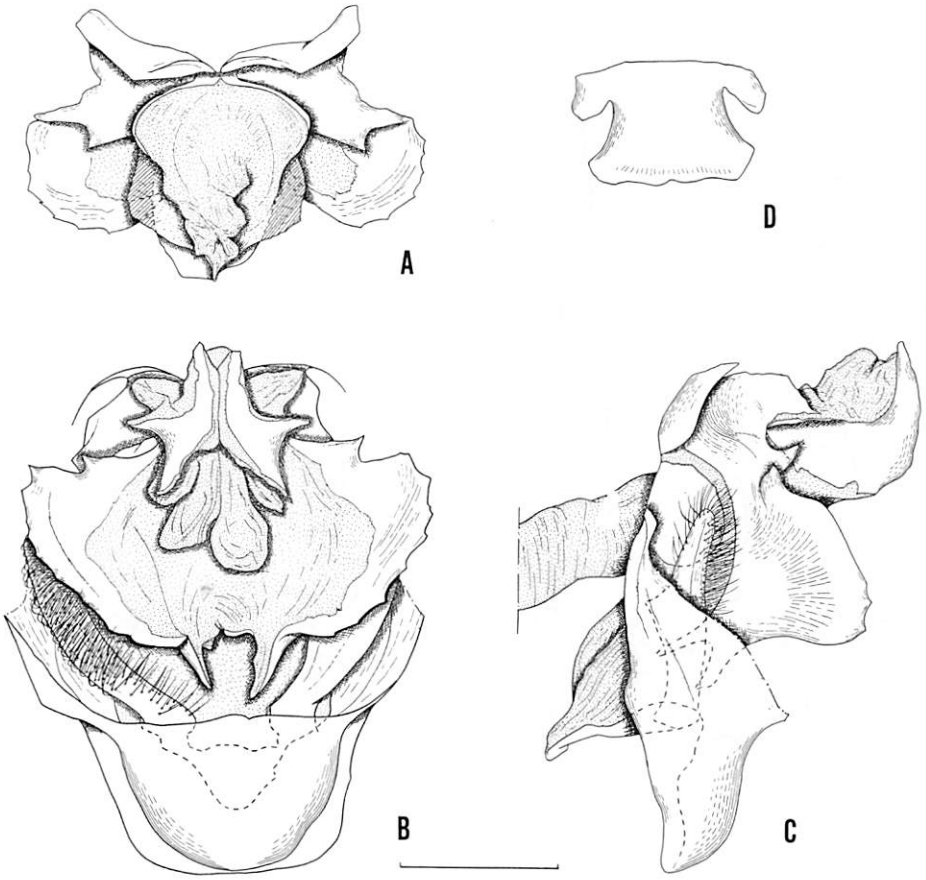
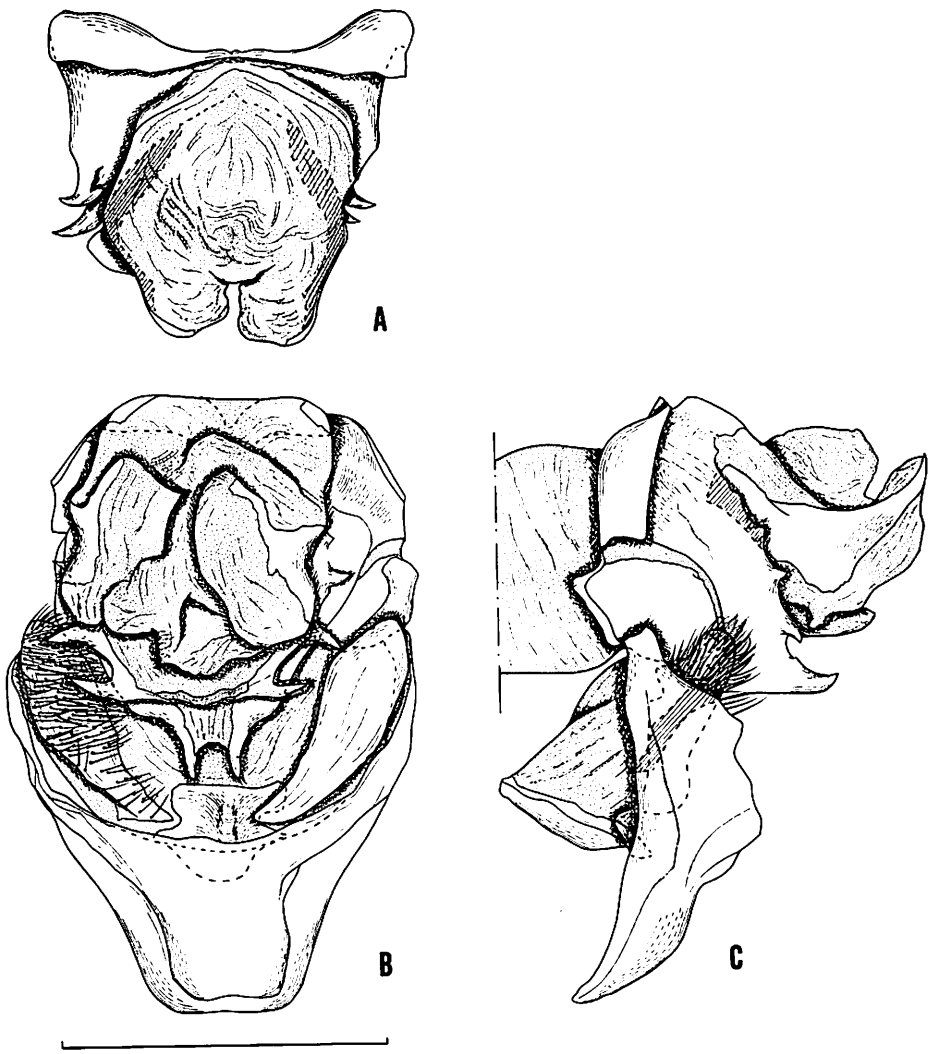


Fig. 9 Male genitalia of *Hepialiscus robinsoni* sp. nov., holotype. A: dorsum, dorsal view. B: whole genitalia, caudal view. C: ditto, lateral view. D: tabulatum, ventral view.

Remarks. *H. robinsoni* is the largest species of this genus in Taiwan. It differs from the other species in having broken white subterminal line in the fore wing, a wide tegumen, and a subanal sclerite with a strong dorsal projection at the distal end. The species name is dedicated to Dr. G. S. Robinson of the British Museum (Natural History) who correctly suggested its systematic position first.

Hepialiscus taiwanus sp. n.

♂. 14 mm. Head: vertex and frons dark brown with ochreous. Antenna with 15 flagellar segments. Thorax dark brown with buff-brown; tegula dark brown with buff-brown scales apically. Fore wing rust-brown with dark brown and



Figs. 10 Male genitalia of *Hepialiscus taiwanus* sp. nov., holotype. A: dorsum, dorsal view. B: whole genitalia, caudal view. C: ditto, lateral view.

buff-brown; small white spots in and below cell; a broken white postmedial line below R5 to posterior margin; subterminal markings white and obsolete; a small white spot edged with dark brown at base of posterior margin. Hind wing greyish brown; apical portion of costa slightly tinged with buff-brown. Legs buff-brown. Abdomen dark brown with ochreous.

♀. Unknown.

♂ genitalia. Tegumen as wide as long; subanal sclerite gradually tapering

posteriorly and terminating in an acute tip; posterior margin of tegumen with three acute processes; processus momenti definitely separated from tegumen by membrane, broad and rounded; valvella sharply pointed posteriorly. Valva rather broad, as long as wide. Mesosome terminating in a pointed tip.

Distribution. Taiwan.

Material examined.

Holotype ♂, Taiwan: Schangpaling (1,100 m alt.), Taoyuan Hsien, 26. x. 1985, K. KANMIYA leg. (KMNHIR000,227) (genital slide No. 2; KMNH).

Remarks. *H. taiwanus* was collected by Dr. KANMIYA while sweep-netting bushes for Diptera. It differs from the other species by the gradually tapering subanal sclerite of the male genitalia.

Hepialiscus monticola sp. n.

♂ 16 mm. Head: vertex dark brown with ochreous; frons darker. Antenna with 17 flagellar segments and black. Thorax dark brown with ochreous; tegula dark brown with ochreous apically. Fore wing ochreous patterned with dark brown; dark brown diffuse subterminal line; on the posterior margin a conspicuous white mark in the middle, edged with dark brown and filled with ochreous; two small white spots at base of posterior margin; cilia dark brown tinged with ochreous. Hind wing fuscous slightly tinged with ochreous at the apex; cilia fuscous. Legs ochreous with dark brown. Abdomen dark brown with ochreous.

♀ 18 mm. Head: vertex and frons buff-brown. Antenna with 15 flagellar segments, brown. Thorax buff-brown with dark brown; tegula dark brown with ochreous apically. Fore wing cloudy buff-brown, patterned with indistinct fuscous markings; broken fuscous subterminal line on posterior margin, a large white mark beyond middle; cilia chequered with pale brown and fuscous. Hind wing fuscous slightly tinged with ochreous on costa and apex; cilia chequered with ochreous and fuscous. Legs buff-brown. Abdomen buff-brown with dark brown.

♂ genitalia. Tegumen as wide as long; subanal sclerite short, terminating in an irregular distal margin; posterior margin of tegumen with small serrations; processus momenti not separated from tegumen, but heavily sclerotized; valvella sharply pointed ventrally. Valva small, narrow and as long as wide. Mesosome terminating in a blunt tip.

♀ genitalia. Ninth abdominal tergum with well produced lateroposterior margin. Ninth abdominal sternum with a pair of lateral processes strongly produced inwardly and terminating in an acute tip; medial region produced dorsally and forming a central process with a narrow posterior margin. A pair of subanal plates present in middle of diaphragma. A small pouch present in anterior region of

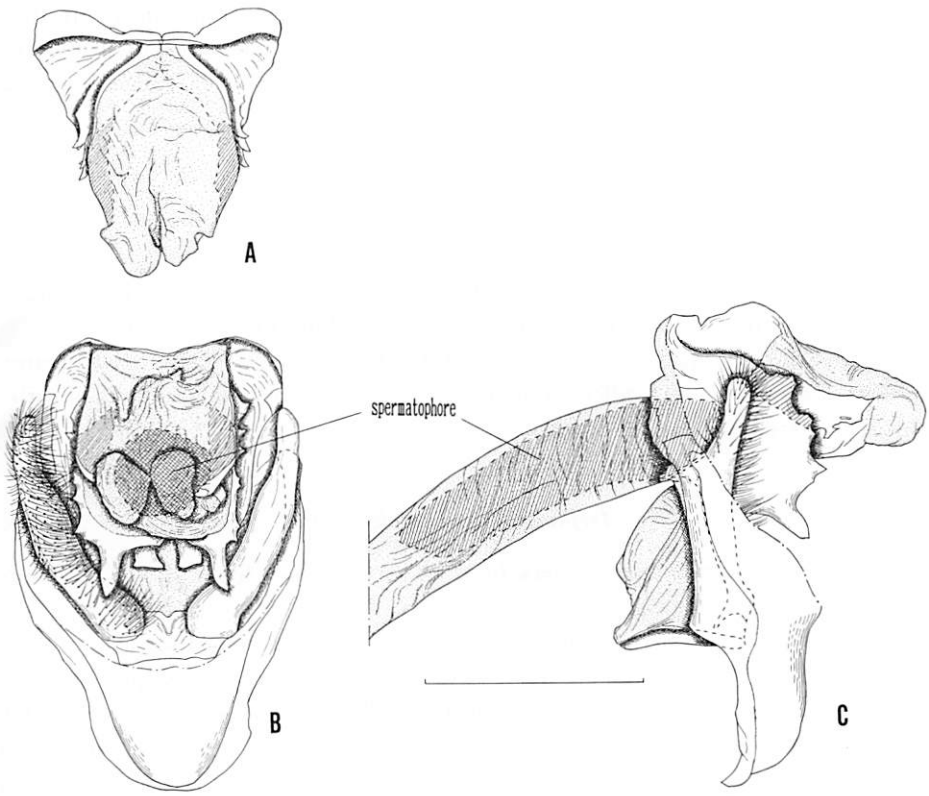


Fig. 11 Male genitalia of *Hepialiscus monticola* sp. nov., holotype. A: dorsum, dorsal view. B: whole genitalia, caudal view. C: ditto, lateral view.

corpus bursae. Signum-like structure present on corpus bursae.

Distribution. Taiwan.

Material examined.

Holotype ♂, Taiwan: Meifeng (2,000 m alt.), Nantou Hsien, 28. xii. 1985, H. NAKAJIMA leg. (in Dr. H. INOUE's collection).

Paratype ♀, Taiwan: same data as holotype. (KMNHIR000,228)(genital slide No. 3; KMNH).

Remarks. The two specimens of *H. monticola* were collected in copula by Mr. Hideo NAKAJIMA at about 5.30 p.m. after sunset. They were resting on the trunk of a large tree, and Mr. NAKAJIMA took the important photographs of them (Fig. 13–A, B). Prior to dissecting the male and female genitalia I carefully boiled them in

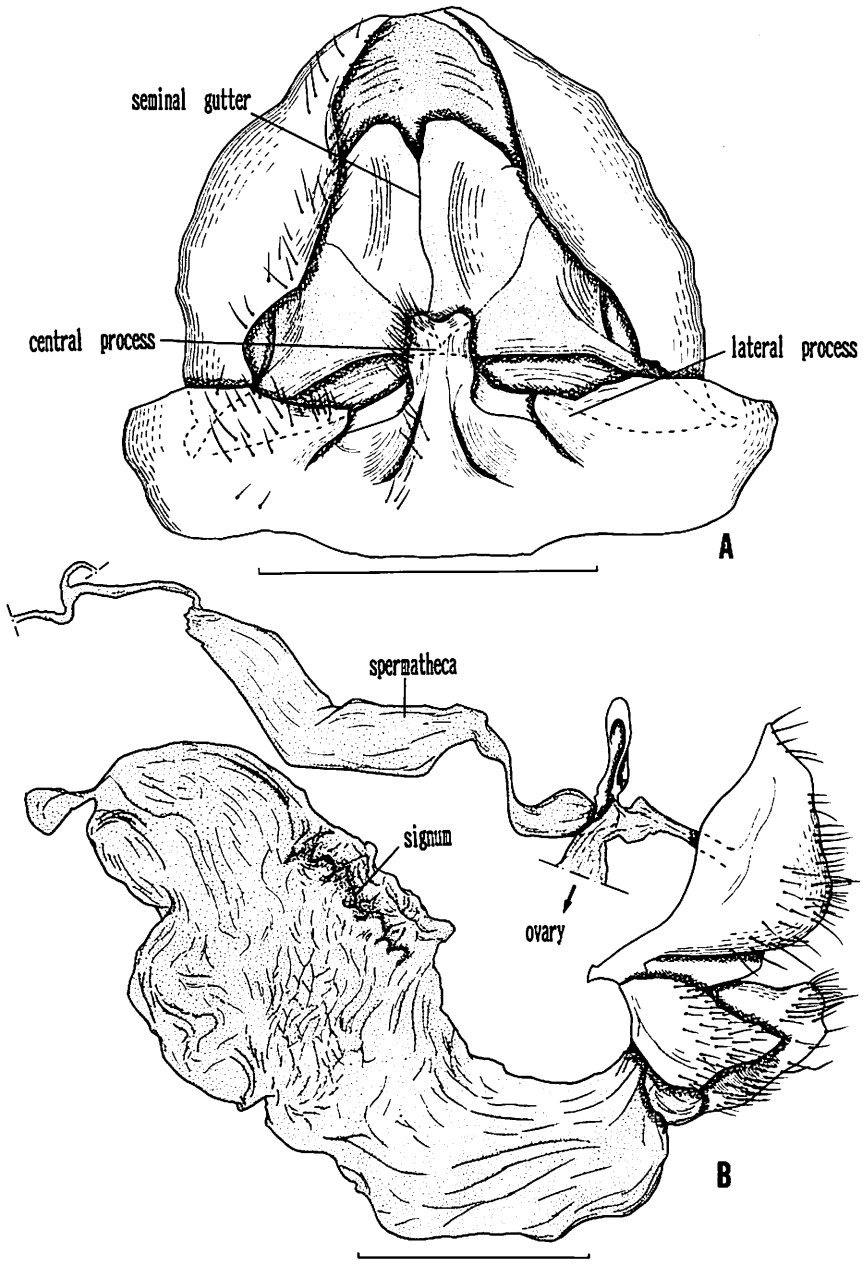


Fig. 12 Female genitalia of *Hepialiscus monticola* sp. nov., paratype. A: ninth abdominal segment, caudal view. B: whole genitalia, lateral view.

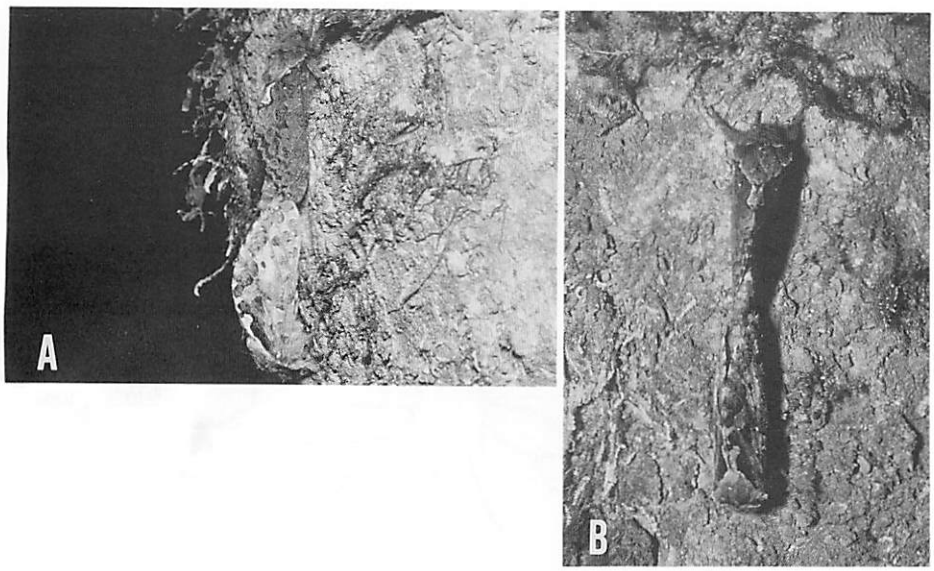


Fig. 13 *Hepialiscus monticola* sp. nov., ♂ holotype, ♀ paratype in copula. A: lateral view. B: dorsal view (photo by Mr. H. NAKAJIMA, see text).

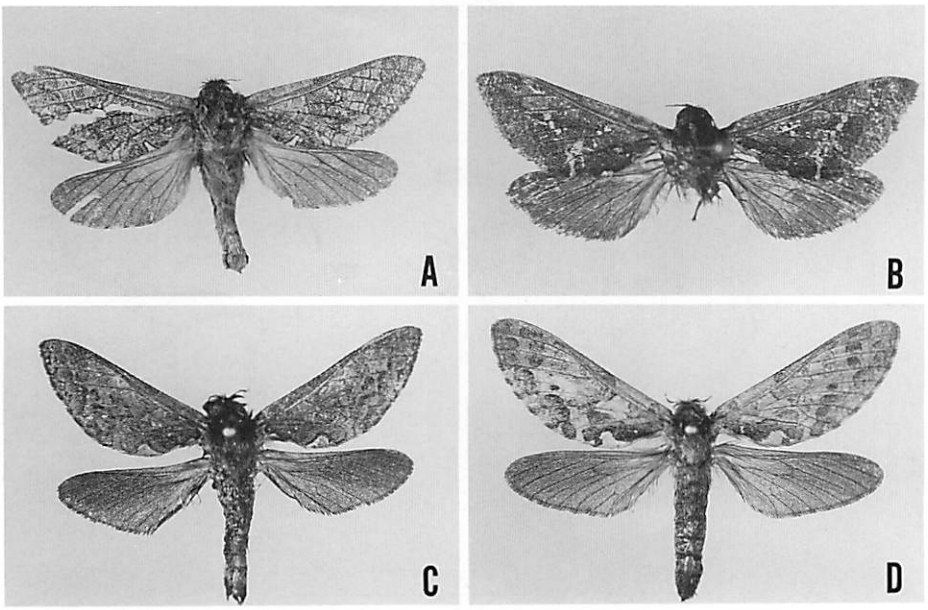


Fig. 14 A: *Hepialiscus robinsoni* sp. n., ♂ holotype, Taiwan. B: *Hepialiscus taiwanus* sp. n., ♂ holotype, Taiwan. C: *Hepialiscus monticola* sp. n., ♂ holotype, Taiwan. D: ditto, ♀ paratype, Taiwan.

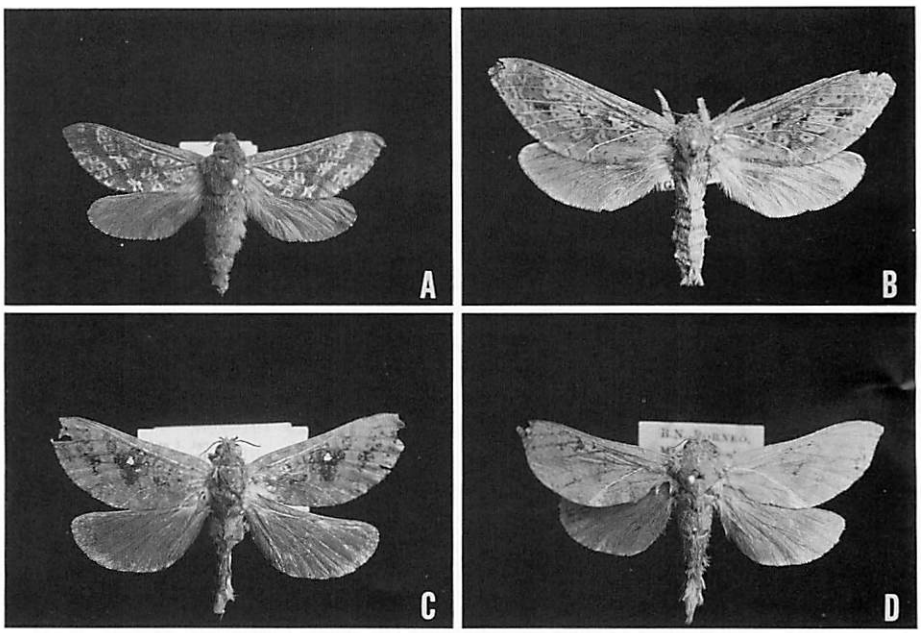


Fig. 15 A.: *Hepialiscus nepalensis* (WALKER), ♂ Bhim Tal, India. B: ditto, ♀, Sikkim, India. C: *Hepialiscus borneensis* PFITZNER, ♂ Sarawak, Borneo. D: ditto, ♀, Mt. Kinabalu, Sabah, Borneo. A–D in the collection of British Museum (Natural History).

water, and found that spermatophore transfer was not yet complete (Fig. 11–B, C). Judging from its position, it may be inferred that the subanal sclerite functions as the "spermatophore guide" during copulation, like the valvella of *Endoclita excrescens* (BUTLER) and *Korscheltellus fusconebulosus* (De GEER) (UEDA, 1981).

H. monticola differs from the other species in having a large white mark on the posterior margin of the fore wing and a rather short subanal sclerite with an irregular distal margin.

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